NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210 MIDTERM EXAM II 11/97 Prof. Powers

- This exam is open book and notes.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be sure to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.
- Enter your name in the space provided.

1	
2	
3	
Total	

Name: _____

1. A carbon monoxide laser (i.e., a CO laser) operates at $\lambda = 5.4$ μm at 77K. Its lineshape is Doppler-broadened. Calculate the value of the lineshape factor, $g(\nu)$, at the frequency $\nu = \nu_0 + (\Delta\nu/2)$.

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2. An optical resonator consists of the two curved mirrors shown in the figure. The left mirror has a radius-of-curvature magnitude of 2 meters. The right mirror has a radius-of-curvature magnitude of A meters. The separation of the mirrors is 1 meter. For what values of radius-of-curvature magnitude, A, will the resonator be stable?

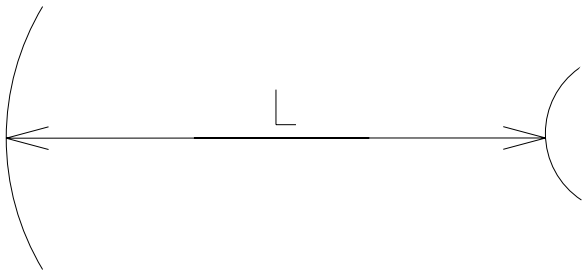

Figure 1: Geometry of the optical resonator of Problem 2.

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3. Consider a laser with the properties given in the following table. Calculate the value of the internal loss coefficient, α_{int}, for the lasing medium in units of m^{-1} at $\nu = \nu_0$.

Parameter	Value
Left mirror power reflectivity	100%
Right mirror power reflectivity	98%
Mirror separation	15 cm
Length of lasing medium	15 cm
Diameter of lasing medium	6 mm
Refractive index of lasing medium	1.40
Lasing wavelength	1.06 μm
Lineshape	Gaussian
Linewidth	1 GHz
Threshold population inversion	6.9×10^{11} atoms
B_{ij}	1×10^{18} $\text{s}^{-2}\cdot\text{j}^{-1}\cdot\text{m}^3$